

WHAT IS CLAIMED IS:

1. An apparatus for generating hydrogen gas, the apparatus comprising:

a storage tank in which fuel comprised of one of decahydronaphthalene and a substance that includes decahydronaphthalene as a principal component is stored;

supplying means connected to the storage tank for supplying fuel from the storage tank;

a reaction tank which includes a catalyst and a heater for heating the catalyst, the reaction tank being connected to the supplying means for receiving fuel supplied by the supplying means from the storage tank, the supplied fuel forming a liquid-film on the catalyst and being dehydrogenated to generate naphthalene and hydrogen gas; and

a separation tank which includes hydrogen gas separation means, the separation tank being connected to the reaction tank for receiving naphthalene and hydrogen gas, and the hydrogen gas separation means separating hydrogen gas out of received naphthalene and hydrogen gas for discharge of the hydrogen gas.

2. The apparatus of claim 1, further comprising a regeneration tank which includes another catalyst and another heater for heating the other catalyst, the regeneration tank being connected to the separation tank for receiving naphthalene, wherein the regeneration

tank receives naphthalene and hydrogen gas, and the naphthalene is hydrogenated on the other catalyst.

3. The apparatus of claim 2, further comprising a hydrogen gas storage tank connected to the separation tank for receiving and storing hydrogen gas discharged from the separation tank.

4. The apparatus of claim 3, wherein the hydrogen gas storage tank is connected to the regeneration tank for supplying hydrogen gas to the regeneration tank.

5. The apparatus of claim 4, wherein hydrogen gas is suppliable into the regeneration tank from an external source.

6. An apparatus for generating hydrogen gas, the apparatus comprising:

a storage tank in which fuel comprised of one of decahydronaphthalene and a substance that includes decahydronaphthalene as a principal component is stored;

first supplying means connected to the storage tank for supplying fuel from the storage tank;

second supplying means for supplying naphthalene and hydrogen gas;

a reaction-regeneration tank which includes a catalyst and a heater for heating the catalyst, selectively connectable in fluid

communication to the first supplying means for receiving fuel supplied by the first supplying means and to the second supplying means for receiving naphthalene and hydrogen gas supplied by the second supplying means, wherein, when fuel is received, the fuel forms a liquid-film on the catalyst and is dehydrogenated to generate naphthalene and hydrogen gas, and when naphthalene and hydrogen gas are received, the naphthalene is hydrogenated on the catalyst; and

a separation tank which includes hydrogen gas separation means, the separation tank being connected to the reaction-regeneration tank for receiving naphthalene and hydrogen gas, and to the second supplying means for supplying naphthalene, the hydrogen gas separation means separating hydrogen gas out of received naphthalene and hydrogen gas for discharge.

7. The apparatus of claim 6, further comprising a hydrogen gas storage tank connected to the separation tank for receiving and storing hydrogen gas discharged from the separation tank.

8. The apparatus of claim 7, wherein the hydrogen gas storage tank is connected to the reaction-regeneration tank for supplying hydrogen gas to the reaction-regeneration tank.

9. The apparatus of claim 6, wherein hydrogen gas is suppliable to the reaction-regeneration tank from an external source.

10. The apparatus of claim 1, further comprising a decahydronaphthalene recovering apparatus which recovers unreacted decahydronaphthalene from the reaction tank.

11. The apparatus of claim 6, further comprising a decahydronaphthalene recovering apparatus which recovers unreacted decahydronaphthalene from the reaction-regeneration tank.

12. The apparatus of claim 10, wherein the decahydronaphthalene recovering apparatus is connectable to at least one of the storage tank and the separation tank for supplying decahydronaphthalene thereto.

13. The apparatus of claim 11, wherein the decahydronaphthalene recovering apparatus is connectable to at least one of the storage tank and the separation tank for supplying decahydronaphthalene thereto.

14. The apparatus of claim 1, further comprising:
a hydrogen gas detector connected to the reaction tank for detecting an amount of hydrogen gas generated by dehydrogenation;
and

control means connected to the supplying means for controlling amount of fuel on the catalyst in accordance with the

amount of hydrogen gas detected by the detector to generate at least a predetermined level of hydrogen gas.

15. The apparatus of claim 6, further comprising:

a hydrogen gas detector connected to the reaction-regeneration tank for detecting an amount of hydrogen gas generated by dehydrogenation; and

control means connected to the first supplying means for, when the reaction-regeneration tank is receiving fuel, controlling amount of fuel on the catalyst in accordance with the amount of hydrogen gas detected by the detector to generate at least a predetermined level of hydrogen gas.

16. The apparatus of claim 1, wherein naphthalene is stored in the separation tank.

17. The apparatus of claim 6, wherein naphthalene is stored in the separation tank.

18. The apparatus of claim 2, wherein at least one of tetrahydronaphthalene and decahydronaphthalene is generated in the regeneration tank and supplied to the storage tank.

19. The apparatus of claim 6, wherein at least one of tetrahydronaphthalene and decahydronaphthalene is generated in the

regeneration tank and supplied to the storage tank.

20. The apparatus of claim 1, wherein the hydrogen gas separation means comprises at least one of an adsorption-permeation device which adsorbs naphthalene and decahydronaphthalene and permeates hydrogen gas, a hydrogen gas separation film, and a cooling device which cools naphthalene and hydrogen gas.

21. The apparatus of claim 6, wherein the hydrogen gas separation means comprises at least one of an adsorption-permeation device which adsorbs naphthalene and decahydronaphthalene and permeates hydrogen gas, a hydrogen gas separation film, and a cooling device which cools naphthalene and hydrogen gas.

22. The apparatus of claim 1, wherein the catalyst comprises at least one of a carbon-supported Pt catalyst, a carbon-supported Pt-Ir bimetallic catalyst, a carbon-supported Pt-Re bimetallic catalyst and a carbon-supported Pt-W bimetallic catalyst.

23. The apparatus of claim 6, wherein the catalyst comprises at least one of a carbon-supported Pt catalyst, a carbon-supported Pt-Ir bimetallic catalyst, a carbon-supported Pt-Re bimetallic catalyst and a carbon-supported Pt-W bimetallic catalyst.

24. The apparatus of claim 1, wherein the substance that includes

decahydronaphthalene as a principal component comprises at least one of a mixed fuel of decahydronaphthalene and tetrahydronaphthalene, and a naphthene-based fuel that includes decahydronaphthalene.

25. The apparatus of claim 6, wherein the substance that includes decahydronaphthalene as a principal component comprises at least one of a mixed fuel of decahydronaphthalene and tetrahydronaphthalene, and a naphthene-based fuel that includes decahydronaphthalene.

26. The apparatus of claim 1, further comprising a tetrahydronaphthalene storage tank connected to the reaction tank, tetrahydronaphthalene being supplied therefrom to the heated catalyst and dehydrogenated prior to commencing dehydrogenation of the fuel.

27. The apparatus of claim 6, further comprising a tetrahydronaphthalene storage tank connected to the reaction-regeneration tank, tetrahydronaphthalene being supplied therefrom to the heated catalyst and dehydrogenated prior to commencing dehydrogenation of the fuel.